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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 79014 HD/ve	FOR FURTHER ACTION See Form PCT/PEA/416	
International application No. PCT/DK2004/000296	International filing date (day/month/year) 30.04.2004	Priority date (day/month/year) 02.05.2003
International Patent Classification (IPC) or national classification and IPC H01Q1/50, H01P1/30		
Applicant LGP ALLGON A/S ET AL.		
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 8 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>		
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>		
Date of submission of the demand 01.03.2005	Date of completion of this report 02.06.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Pastor Jiménez, J-V Telephone No. +31 70 340-4965 	

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**INTERNATIONAL PRELIMINARY REPORT
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Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

1, 2, 6-12	as originally filed
3, 3a, 4, 5	received on 03.03.2005 with letter of 01.03.2005

Claims, Numbers

12, 13	as originally filed
8-11	received on 03.03.2005 with letter of 01.03.2005
1-7	filed with telefax on 20.05.2005

Drawings, Sheets

1/3-3/3	as originally filed
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- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☒ the claims, Nos. 8-11
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing *(specify):*
 - ☐ any table(s) related to sequence listing *(specify):*
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing *(specify):*
 - ☐ any table(s) related to sequence listing *(specify):*

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-7
	No: Claims	
Inventive step (IS)	Yes: Claims	1-7
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-7
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following document:

D1: US-A-5 508 873 (KNAPP WALTER ET AL) 16 April 1996 (1996-04-16)

D2: US 2002/135963 A1 (PAGLIUCA EMANUEL J) 26 September 2002 (2002-09-26)

2. The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and shows (the references in parentheses applying to this document):

Microwave transmission unit (fig. 1), such as a microwave filter, including a cabinet (fig. 1, (12)) with a first coaxial connector and a second coaxial connector (fig. 1, (16)), where both coaxial connectors include an inner conductor and an outer conductor, said cabinet being made of a non-conducting material, such as plastics, and coated with a metal layer (column 3, lines 25-26), the microwave transmission unit includes a lightning conductor (Fig. 1, (14)) which is dimensioned so as to conduct lightning current without being damaged to any serious extent (column 3, lines 26-28), in that the lightning conductor is formed by a mounting member for mounting of the microwave transmission unit on a structural part, which is electrically connected to the outer conductor of the first coaxial connector and to the outer conductor of the second coaxial connector (column 3, lines 64-67).

The subject-matter of claim 1 differs from this known microwave transmission unit in that:

- 1) the mounting member includes a metal body of a cross-sectional area of minimum 10 to 200 mm²;
- 2) the lightning conductor formed by a mounting member is electrically connected to the outer conductor of the two coaxial connectors **by means of fittings**.

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

3. The problem to be solved by the present invention may be regarded as how to ensure that the major portion of the lightning current runs through the metal body and not through the metal coating of the cabinet (description, page 3a, lines 20-21).

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The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

The prior art at hand does not disclose or suggest to solve the problem in the claimed manner.

Therefore, the subject-matter of independent claim 1 is novel and inventive over the prior art.

4. Claims 2-7 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

Re Item VIII

5. The application does not meet the requirements of Article 6 PCT, because claim 1 is not clear.
 - 5.1. As the examiner pointed in the telephone minutes, it is clear from the description on page 7, line 24 to page 8, line 2, figure 1 that the following feature is essential to the definition of the invention:

(1) the transmission microwave unit comprises a cover made of a solid metal closing the cabinet.

Since independent claim 1 does not contain this feature it does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

- 5.2. Although claim 1 is drafted in the two-part form the following features are incorrectly placed in the characterising portion, as they are disclosed in document D1 in combination with the features placed in the preamble (Rule 6.3(b) PCT).
 - the lightning conductor is formed by a mounting member for mounting of the microwave transmission unit on a structural part, which is electrically connected to the outer conductor of the first coaxial connector and to the outer conductor of the second coaxial connector.

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filters can be made of plastics, such as by way of moulding, where the plastic surface is subsequently coated with a metal capable of conducting the electric signals to be subjected to a filtering. The coating process can be in form of activation by means of palladium, autocatalytic deposition of nickel or copper followed by an electrolytic deposition of for instance silver. Such a metal coating is in practice often of a thickness of 5 to 200 μm , which suffices completely for conducting aerial signals of an average effect of up to a few hundred watts. However, a strong lightning current can cause a damaging heating of the metal coating due to the relatively high ohmic resistance and low heat capacity of said metal coating.

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US 5.502.715 (Penny) discloses a microwave filter which can be made of metallised plastics. According to this publication the risk of potential damages caused by strokes of lightning can be reduced by grounding the ports of the filter. The microwave filter of this publication is in form of a diplex filter including a first coaxial connector and a second coaxial connector, where both coaxial connectors are used as input and output connectors, respectively.

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US 5.508.873 discloses a surge protector for broadband coaxial systems, wherein the cabinet is made of metal or metallised plastics. It is not mentioned in this patent how the metallisation layer can be protected from a strong lightning current running between the outer conductors of the coaxial connectors and causing a damaging heating of the metallisation layer.

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3 a

Description of the Invention

The object of the invention is to improve the lightning protection of a microwave transmission unit of the above type.

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The object is according to the invention obtained by the metal coating of the cabinet being 5-200 μm thick and the microwave transmission unit including a lightning conductor which is dimensioned so as to conduct lightning current without being damaged to any serious extent, and which is electrically connected to the outer conductor of the first coaxial connector and to the outer conductor of the second coaxial connector, said lightning conductor includes a metal body of a cross-sectional area of at least 10-200 mm^2 . As a result, a lightning current running in an outer conductor of a coaxial connector connected to the first coaxial connector can be efficiently conducted to the outer conductor of a coaxial connector connected to the second coaxial connector or vice versa without causing damaging heatings of the relatively thin metal layer of the cabinet.

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According to the invention, the lightning conductor includes a metal body of a cross-sectional area of at least 10 to 200 mm^2 . Such a metal body presents an electric resistance being suitably low for ensuring that far the major portion of the lightning current runs through said metal body and not through the metal coating of the cabinet.

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According to another embodiment of the microwave transmission unit according to the invention, the first coaxial connector and the second coaxial connector of the microwave transmission unit may be arranged at their respective ends of the cabinet, where a cover for closing said cabinet includes the lightning conductor.

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According to an advantageous embodiment of the microwave transmission unit according to the invention, the cover is made of metal, such as aluminium, with the result that the cover can per se form the lightning conductor.

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The thickness of the cover can for instance be 3 mm or more.

According to an alternative embodiment of the microwave transmission unit according to the invention, the cover may be made of a non-conducting material, such as
5 plastics, whereby the lightning conductor is in form of a metal body embedded in the non-conducting material.

According to a preferred embodiment of the microwave transmission unit according to the invention, the lightning conductor may be electrically connected to the outer
10 conductor of the first coaxial connector and to the outer conductor of the second coaxial connector by means of fittings which are screwed into the lightning conductor and flanges on the coaxial connectors by means of screws. The resulting embodiment is particularly simple.

15 According to an embodiment of the microwave transmission unit according to the invention, the first coaxial connector and the second coaxial connector may be ar-

ranged at the same end of the cabinet and fastened to a common plate-shaped metal fitting forming the lightning conductor. The resulting embodiment is particularly simple.

- 5 According to an alternative embodiment of the microwave transmission unit according to the invention, the lightning conductor may be in form of a mounting member for mounting the microwave filter on a structural part.

The lightning conductor presents preferably an electric resistance of max. 1 m Ω .

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The total electric resistance between the outer conductors of the coaxial connectors through the lightning conductor is preferably max. 0.1 m Ω , most advantageously max. 0.01 m Ω .

- 15 According to an embodiment of the microwave transmission unit according to the invention, said microwave transmission unit may be in form of a microwave filter of the cavity resonator type including columnar resonators formed integral with the cabinet.

- 20 According to yet another embodiment of the microwave transmission unit according to the invention, the microwave filter may include a trimming plate of solid metal with threaded holes for trimming screws, where the ends of said trimming screws together with the resonators define capacitances, and where the trimming plate forms the lightning conductor. The resulting embodiment is particularly simple.

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Brief Description of the Drawings

The invention is explained in greater detail below with reference to preferred embodiments illustrated in the drawing, in which

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Claims

1. Microwave transmission unit, such as a microwave filter (1), and including a cabinet (2) with a first coaxial connector (3) and a second coaxial connector (4),
5 where both coaxial connectors include an inner conductor (6) and an outer conductor (7), said cabinet (2) being made of a non-conducting material, such as plastics, and coated with a metal layer, **characterised in** that the metal coating of the cabinet (2) is 5 to 200 μm thick, and that the microwave transmission unit (1) includes a lightning conductor (5) which is dimensioned so as to conduct lightning current without
10 being damaged to any serious extent, and which is electrically connected to the outer conductor of the first coaxial connector (3) and to the outer conductor (7) of the second coaxial connector (4), said lightning conductor (5) includes a metal body of a cross-sectional area of minimum 10 to 200 mm^2 .
- 15 2. Microwave transmission unit (1) according to claim 1, **characterised in** that the first coaxial connector (3) and the second coaxial connector (4) are arranged at their respective ends of the cabinet (2), and that the microwave transmission unit (1) includes a cover (5) for closing the cabinet (2), said cover including the lightning conductor.
- 20 3. Microwave transmission unit (1) according to claim 2, **characterised in** that the cover (5) is made of solid metal, preferably aluminium.
- 25 4. Microwave transmission unit (1) according to claim 2, **characterised in** that the cover (5) is made of a non-conducting material, such as plastics, and that the lightning conductor is formed as a metal body embedded in the non-conducting material.
- 30 5. Microwave transmission unit according to one of the preceding claims, **characterised in** that the lightning conductor (5) is electrically connected to the outer conductor (7) of the first coaxial connector (3) and to the outer conductor (7) of the second coaxial connector (4) through fittings (12, 21), which are screwed into said

lightning conductor (5) and a flange (28) on the coaxial connectors (3, 4) by means of screws (19).

6. Microwave transmission unit (1) according to claim 1, **characterised in** that the first coaxial connector (3) and the second coaxial connector (4) are arranged at the same end of the cabinet (2) and are fastened to a common plate-shaped metal fitting forming the lightning conductor.

7. Microwave transmission unit (1) according to claim 1, **characterised in** that the lightning conductor is formed by a mounting member (23) for mounting of the microwave transmission unit on a structural part.

8. Microwave transmission unit (1) according to one of the preceding claims, **characterised in** that the electric resistance of the lightning conductor (5) is max. 1 m Ω .

9. Microwave transmission unit according to one of the preceding claims, **characterised in** that the total electric resistance between the outer conductors of the coaxial connectors (3, 4) through the lightning conductor (5) is max. 0.1m Ω , most advantageously max. 0.01 m Ω .

10. Microwave transmission unit according to one of the preceding claims in form of a microwave filter (1) of the cavity resonator type including columnar resonators (25, 26, 27) formed integral with the cabinet (2).

11. Microwave filter (1) according to claim 10, **characterised in** that it includes a trimming plate (11) of solid metal with threaded holes for trimming screws (11), the free ends of which form capacitances together with the resonators (25, 26, 27), and where the trimming plate (9) forms the lightning conductor.

Claims

1. 1. Microwave transmission unit, such as a microwave filter (1), and including a cabinet (2) with a first coaxial connector (3) and a second coaxial connector (4), where both coaxial connectors include an inner conductor (6) and an outer conductor (7), said cabinet (2) being made of a non-conducting material, such as plastics, and coated with a metal layer, the microwave transmission unit (1) includes a lightning conductor (5) which is dimensioned so as to conduct lightning current without being damaged to any serious extent, characterised in that the lightning conductor is formed by a mounting member for mounting of the microwave transmission unit on a structural part, the mounting member includes a metal body of a cross-sectional area of minimum 10 to 200 mm², which is electrically connected to the outer conductor of the first coaxial connector (3) and to the outer conductor (7) of the second coaxial connector (4) by means of fittings.
2. Microwave transmission unit according to one of the preceding claims, characterised in that the lightning conductor (5) is electrically connected to the outer conductor (7) of the first coaxial connector (3) and to the outer conductor (7) of the second coaxial connector (4) through fittings (12, 21), which are screwed into said lightning conductor (5) and a flange (28) on the coaxial connectors (3, 4) by means of screws (19).
3. Microwave transmission unit (1) according to one of the preceding claims, characterised in that the first coaxial connector (3) and the second coaxial connector (4) are arranged at the same end of the cabinet (2) and are fastened to a common plate-shaped metal fitting forming the lightning conductor.
4. Microwave transmission unit (1) according to one of the preceding claims, characterised in that the electric resistance of the lightning conductor (5) is max. 1 mΩ.

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5. Microwave transmission unit according to one of the preceding claims, characterised in that the total electric resistance between the outer conductors of the coaxial connectors (3, 4) through the lightning conductor (5) is max. 0.1Ω , most advantageously max. 0.01Ω .

5

6. Microwave transmission unit (1) according to one of the preceding claims, characterised in that the metal coating of the cabinet (2) is 5 to $200\mu\text{m}$ thick.

7. Microwave transmission unit according to one of the preceding claims in form of a microwave filter (1) of the cavity resonator type including columnar resonators (25, 26, 27) formed integral with the cabinet (2).

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